Pre-emergent herbicides and mixtures for annual ryegrass control

Declan Anderson and Rebekah Allen; Hart Field-Site Group

Key findings

- All pre-emergent herbicides provided good control of annual ryegrass at Hart in 2021.
- Seasonal conditions in July assisted the least soluble herbicides trifluralin, Arcade® and Sakura® to move actively through the soil and increase weed control.
- Seasonal conditions allowed pre-emergent herbicides to move rapidly through the soil profile, increasing crop bleaching in some herbicides, like Overwatch®.
- Penalties for wheat grain yield were observed at Hart for some trialed herbicide mixtures by up to 15%.

Why do the trial?

Pre-emergent herbicides are the most effective tools used within a spray regime for the control of early weed populations. For annual ryegrass (ARG) control in wheat, pre-emergent herbicides have become important control tactics due to resistance across many post-emergent herbicides (Preston *et al*. 2020). Herbicides with new modes of action, including Overwatch® (active ingredient bixlozone) and Luximax® (active ingredient cinmethylin) provide additional herbicide rotation options for annual ryegrass control, reducing the risk of resistance.

Mateno® Complete is a new herbicide, with commercial registration expected in 2022. The herbicide has three modes of action (active ingredients aclonifen, diflufenican and pyroxasulfone) with use patterns for IBS (incorporated by sowing) and early post-emergent (EPE) in wheat (not durum) and barley. Aclonifen, developed by Bayer, is also a new mode of action (Group 32).

This trial evaluates new pre-emergent herbicides, applied IBS and EPE, standalone or in mixtures, for the control of annual ryegrass in wheat.

How was it done?

Plot size	1.75 m x 10.0 m	**Fertiliser**	DAP (18:20) + 1% Zn + Impact @ 80 kg/ha
Seeding date	May 6, 2021		Easy N (42.5:0) 70 L/ha on June 12, 2021
Location	Hart, SA		Easy N (42.5:0) 70 L/ha on August 20, 2021
Harvest date	November 29, 2021		

The trial was a randomised complete block design with three replicates and 18 herbicide treatments. This trial was managed with the application of pesticides to ensure an insect and disease-free canopy.

All plots were assessed for crop establishment (%), ARG weed counts (plants/m^2), ARG head counts (heads/m^2) and grain yield (t/ha).

Annual ryegrass seed with a known susceptibility to Group 15 herbicides (previously Groups J and K) was broadcast to trial plots and lightly incorporated on May 6, prior to the application of herbicide treatments. Scepter wheat was sown after IBS treatments had been applied using a standard knife-point press wheel system on 22.5 cm (9”) spacings.

Early post emergent treatments were applied on June 28 when ryegrass was at the two-leaf stage, however populations were very low. Herbicides and rates trialed are listed in Table 1.

Table 1. Pre-emergent and early post emergent herbicide treatments applied at Hart in 2021.

	Herbicide Treatment	IBS Product Rate (/ha)	EPE Product Rate(/ha)
1	Nil	-	-
2	Sakura®	118 g	-
3	Sakura® + Avadex® Xtra	118 g + 2 L	-
4	Mateno® Complete	1 L	-
5	Luximax®	500 mL	-
6	Luximax® + Avadex® Xtra	500 mL + 2 L	-
7	Luximax® + Arcade®	500 mL + 3 L	-
8	Luximax® + Sakura®	500 mL + 118 g	-
9	Overwatch®	1250 mL	-
10	Overwatch® + Avadex® Xtra	1250 mL + 2 L	-
11	Overwatch® + Arcade®	1250 mL + 3 L	-
12	Overwatch® + Sakura®	1250 mL + 118 g	-
13	Trifluralin + Avadex® Xtra	1.5 L + 2 L	-
14	Boxer Gold® + Avadex® Xtra	2.5 L + 2 L	-
15	Trifluralin + Avadex® Xtra + Mateno® Complete (EPE)	1.5 L + 2 L	1 L
16	Trifluralin + Avadex® Xtra + Arcade® (EPE)	1.5 L + 2 L	3 L
17	Trifluralin + Avadex® Xtra + Boxer Gold® (EPE)	1.5 L + 2 L	2.5 L

Results and discussion

Annual ryegrass control

Early growing season conditions at Hart were dry, with a significant opening rain event occurring on May 25, approximately three weeks post-seeding. Rainfall initiated crop germination with wheat emerging on May 31. Dry April and May conditions were followed by average June rainfall (43 mm) and a wetter than average July, of 63 mm (Figure 1).

Rainfall events in May allowed ARG to germinate and pre-emergent herbicides to move quickly through the soil profile, (Preston, 2021) increasing the potential for crop damage. This was exacerbated by herbicides with higher water solubility, particularly when soil conditions had previously been dry (Preston, 2021). Crop bleaching was observed in plots where Overwatch® herbicides were applied IBS. The effects observed in these plots at Hart displayed slight and temporary discolouration and crop establishment was not affected.

Dry conditions after mid-August resulted in no further ARG emergence.

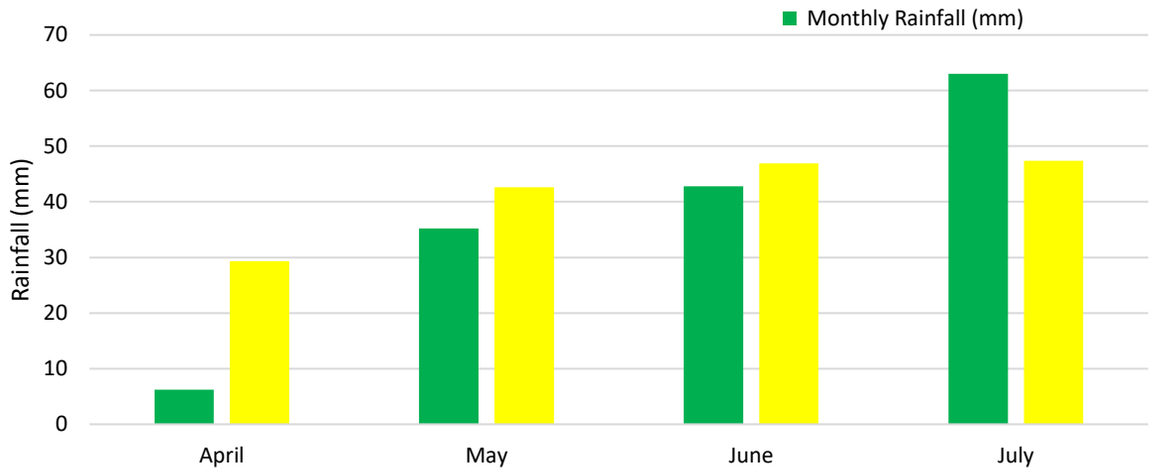

Figure 1. Total monthly rainfall and the 100-year average rainfall for April – July for Hart in 2021.

Table 2. The effect of pre-emergent herbicides on crop establishment, ARG plant counts (8 weeks after sowing) and ARG head counts at Hart in 2021.

Herbicide Treatment	Crop Establishment (plants/m^2)	Annual Ryegrass (plants/m^2)	Annual Ryegrass (heads/m^2)
Nil	132	160^{b}	105^{c}
Sakura®	135	6^{a}	0^{a}
Sakura® + Avadex® Xtra	137	3^{a}	0^{a}
Mateno® Complete	110	3^{a}	0^{a}
Luximax®	137	11^{a}	6^{b}
Luximax® + Avadex® Xtra	124	3^{a}	6^{b}
Luximax® + Arcade®	145	3^{a}	2^{a}
Luximax® + Sakura®	135	2^{a}	0^{a}
Overwatch®	128	7^{a}	2^{a}
Overwatch® + Avadex® Xtra	139	5^{a}	2^{a}
Overwatch® + Arcade®	140	3^{a}	1^{a}
Overwatch® + Sakura®	134	2^{a}	0^{a}
Trifluralin + Avadex® Xtra	155	8^{a}	3^{ab}
Boxer Gold® + Avadex® Xtra	145	5^{a}	3^{a}
Trifluralin + Avadex® Xtra + Mateno® Complete (EPE)	126	0^{a}	0^{a}
Trifluralin + Avadex® Xtra + Arcade® (EPE)	154	4^{a}	0^{a}
Trifluralin + Avadex® Xtra + Boxer Gold® (EPE)	118	6^{a}	1^{a}
LSD (P≤0.05)	**NS**	**12.0**	**3.48**

Values with the same letter are not significantly different.

All pre-emergent herbicides provided good control of annual ryegrass at Hart in 2021 (Table 2).

The pre-emergent herbicides trialed had similar levels of control for ARG, providing up to 100% control (0 plants/m^2) when compared to the nil treatment (160 plants/m^2). May rainfall events, followed by consistent winter rainfall assisted the least soluble herbicides of trifluralin, Arcade® and Sakura® to control ARG populations, which would otherwise be difficult in drier years (Preston, 2021).

These results are in contrast to the 2020 growing season at Hart, where Luximax® and Overwatch® both provided greater control of ARG under very dry winter conditions, likely due to their greater water solubility when compared to Sakura® and Arcade® (Preston *et al*. 2020).

All pre-emergent herbicides provided excellent control of ARG head emergence at Hart in 2021. Results from pre-emergent herbicides trialed in 2020 show that Luximax® and Overwatch® standalone and in mixtures were able to reduce ARG seed set, when compared to other chemistries in dry conditions. Sakura®, although less soluble than Overwatch® and Luximax®, has also shown the ability to reduce seed set of ARG by disrupting growth of established plants, even when higher populations are present (Preston *et al*. 2020).

The nil treatment (160 plants/m^2) was observed to be one of the highest yielding treatments, showing that crop competition across moderate ARG populations is good, and that yield reductions observed were the result of herbicide mixtures trialed.

The most significant yield penalty observed was for the Luximax® and Sakura® mixture. This mix is not on label and is not recommended due to the increase in crop damage.

Table 3. Grain yield (t/ha) of all herbicide treatments at Hart in 2021. Shaded values show the highest performing treatments.

Herbicide Treatment	**Grain yield (t/ha)**
Nil	2.54^{cde}
Sakura®	2.50^{abc}
Sakura® + Avadex® Xtra	2.47^{abc}
Mateno® Complete	2.49^{abc}
Luximax®	2.35^{ab}
Luximax® + Avadex® Xtra	2.40^{abc}
Luximax® + Arcade®	2.57^{cde}
Luximax® + Sakura®	2.32^{a}
Overwatch®	2.71^{de}
Overwatch® + Avadex® Xtra	2.57^{cde}
Overwatch® + Arcade®	2.56^{cde}
Overwatch® + Sakura®	2.38^{abc}
Trifluralin + Avadex® Xtra	2.55^{cde}
Boxer Gold® + Avadex® Xtra	2.57^{cde}
Trifluralin + Avadex® Xtra + Mateno® Complete (EPE)	2.55^{cde}
Trifluralin + Avadex® Xtra + Arcade® (EPE)	2.73^{e}
Trifluralin + Avadex® Xtra + Boxer Gold® (EPE)	2.52^{bcd}
LSD (P≤0.05)	**0.197**

Values with the same letters are not significantly different.

Acknowledgements

The Hart Field-Site Group would like to acknowledge the generous support of our sponsors who provide funding that allows us to conduct this trial. Proceeds from Hart's ongoing commercial crop also support Hart's research and extension program.

We would like to thank Peter Boutsalis for providing the annual ryegrass seed to conduct this trial.

References

Preston C 2021, 'Pre-emergent herbicide performance in 2021', *2021 Hart Field Day Guide, 67 – 68.*

Preston C & Allen R 2020, 'Annual ryegrass control with new pre-emergent herbicides and mixtures', *2020 Hart Trial Results Book, 63 – 65.*

Photo. Pre-emergent herbicides and mixtures for annual ryegrass control; the trial at Hart, 2021.